

cases as though it were an indifferent gas; that the concentration of the dissociated portion of a salt may be substituted for the total concentration; &c., &c. The result is that our calculations apply at best only to limiting or ideal cases, where an error in deducing the formula may be masked by the error of observation. Helmholtz did not do this, but Helmholtz is considered old-fashioned."

What Mr. Bancroft would have us do is to study concentrated solutions. The object is most laudable; but until a Helmholtz appears who is capable of attacking the problem in all its complexity, physical chemists will probably continue their work on dilute solutions, for which the conditions are comparatively simple, and the behaviour of which is represented closely by the results deduced from a consideration of the limiting or ideal cases above referred to.

There is one point about many of the reviews (and some of the original contributions) which calls for remark—they seem needlessly scathing. Should any one be so unfortunate as to differ in opinion from the reviewer, he is forthwith tomahawked, and his scalp brandished in triumph before the horrified reader. It is painful to see one's friends—nay, even one's enemies—ruthlessly butchered in this fashion, and we would earnestly counsel a less close adherence to the former methods of the Wild West.

J. W.

#### THE EXPLORATION OF THE UPPER AIR.

*Sounding the Ocean of Air.* Being six lectures delivered before the Lowell Institute of Boston in December, 1898. By A. Lawrence Rotch, S.B., A.M. "Romance of Science" Series. Pp. viii + 184. (London: Society for Promoting Christian Knowledge, 1900.)

A CORDIAL welcome for this little book may be anticipated from the fact that it is the latest addition to the series which has given us Boys's "Soap Bubbles," Perry's "Spinning Tops," Worthington's "Splash of a Drop" and Sir R. Ball's "Time and Tide." Its author has won for himself a prominent place among those who are best acquainted with modern ways of sounding the ocean of air, by the work done at his observatory at Blue Hill, Massachusetts, and by his personal association with the observers of clouds and the users of balloons and kites in Europe.

Perhaps the very width and depth of his acquaintance with the details of the subject have made the task of the popular exposition of it in six short chapters a difficult one. The procession of facts, each one of great interest in itself, is apt to become panoramic and even kaleidoscopic; and when one page, or sometimes one paragraph, has to accommodate a succession of scientific ideas, the inexperienced reader may find himself a little bewildered with the rapidity of the transitions, and occasionally even with some short cuts to scientific conclusions.

After a short historical introduction the book deals successively with the exploration of the upper air by means of clouds, balloons and kites. Each section gives a brief account of the earlier experiments, before treating of the recent results. The romance begins in the first chapter with a striking diagram of the heights of certain observatories, mountain peaks, kites and balloons, showing one balloon—an unmanned one, be it said—

at the almost incredible height of 13 miles or more (upwards of 70,000 feet), where the corresponding barometric pressure is about one and a half inch of mercury; it culminates in the chapter describing these extremely lofty ascents. The chapters on the various types of balloon, captive balloons, free balloons and *ballons sondes* (unmanned balloons) are, both from the historic and the scientific point of view, the most interesting to the general reader. The study of clouds is clearly too large a subject for a single chapter; and the final chapters, which are devoted to the description of kites and the results obtained at Blue Hill, enter into details which the meteorologist will find of great value and interest, but which require close attention from the reader. The diagrams with which the book is illustrated have suffered a little from the reduction in scale for the purpose of reproduction; but the reader who will take the trouble to follow them carefully with the text will be rewarded by obtaining an excellent survey of the work done with kites up to a height of 12,000 feet, and some idea as to what they may be expected to accomplish in the future.

One side of the romance of kite work is only touched with a light hand. The Berlin experimenters could supply at least one thrilling story of a kite that absconded for the night with its wire, and made a long and very eventful journey; but Blue Hill has perhaps been more fortunate; doubtless its situation lends itself less easily to romantic exploits of that description.

It is interesting to notice the geographical distribution of the work of exploring the upper air as it appears in Mr. Rotch's account. Speaking quite generally, the United States are conspicuous for the work with kites, Germany for various forms of manned balloons, and France for *ballons sondes*, although the most adventurous of these last, the "Cirrus," belonged also to Berlin; while cloud work is more evenly distributed, the services of Hildebrandsson in that department render Sweden conspicuous. Great Britain is credited with an active share in the initiation or early development of the scientific exploration of the air by clouds, balloons and kites in turn, but in later years seems to have withdrawn from such enterprises.

Mr. Rotch's interesting lectures may well leave the impression that the further sounding of the upper air of the British Isles might be exciting on account of the special situation and circumstances of the islands, but, for the same reason, would be of great scientific importance.

#### OUR BOOK SHELF.

*The Locust Plague and its Suppression.* By Æneas Munro, M.D., Edinb. and Cordova, Fellow of the Faculty of Physicians and Surgeons of Glasgow. With illustrations. Pp. xvi + 365. (London: Murray, 1900.)

THE volume before us has been prepared by the author after nearly ten years' observation of locust ravages in the Argentine Republic and in South Africa. He is profoundly convinced of the enormous damage caused by locusts in various parts of the world, and has brought together a considerable amount of information respecting the various means which have been adopted for destroying them. Dr. Munro writes from a practical point of view,

and treats the locusts of different countries as, to all intents and purposes, the same insect. His book will no doubt be very useful to agriculturists in countries infested by locusts; but he scarcely allows for the variations in habit which exists between different species. For instance, he observes that the South American locusts are said to breed on the shores of certain lakes in Bolivia, and asserts that if they could be destroyed in this locality they would be exterminated from the whole of South America (!). It is hardly possible to take such a remark seriously; but we may perhaps observe that even if the story were true, it could only be true of one or two species at most. It is also suggested that ophthalmia in Egypt (well known to be spread by flies) may be caused by locusts.

Dr. Munro also claims that his book is the first on the subject; but we are more inclined to think that a locust bibliography would fill a book as large as his own. Besides, some of his illustrations appear to be taken from American works.

An interesting account is given of the appearance of what is called the "new" locust in South Africa, and he quotes from Mr. Péringuey: "The present species was very closely allied to *Acridium peregrinum*, and in the same way that that species had swarmed into Algeria after the myriads of a smaller locust, *Stauronotus* (not *Jauronotus*, as printed) *maroccanus*, had been destroyed at great expense, this present species was following in the rear of a smaller locust, *Pachytylus migratorius*" (§ 166). One curious point is that the "new locust" is said to be unwholesome, if not actually poisonous, by the natives. However, in § 32, under the heading, "Scientific Definition," we read, "the locust we have here (in Africa) is, to all intents and purposes, the same insect called technically the *Acridium peregrinum*, *Locusta migratoria*, or the wandering locust" (Fig. 4a, p. 37). Here it will be seen that two species, by no means closely related, are spoken of as if they were the same; and on turning to p. 37 we find two figures of locusts, specified as "The African Locust" and "The South American Locust," as if there was only one species in each continent.

The book is very diffusely written, and treats of a great variety of subjects, some of them rather irrelevant to the locust question. It is, however, divided into 900 numbered paragraphs, and provided with an excellent index, which will make it a useful book of reference, though it would be rather a formidable undertaking to read it through from cover to cover.

*Leçons d'Anthropologie Philosophique, ses Applications à la Morale Positive.* Par D. Folkmar. Pp. xiv + 336. (Paris: Schleicher Frères, 1900.)

SCIENCE exists for the sake of something beyond itself. Doing, not knowing, is what determines the place and significance of any body of doctrine in the hierarchy of arts and sciences. The synthesis of the human sciences in the light of their worth for action is not effected by sociology. This fails to include certain individual sciences. In this way Prof. Folkmar makes the transition from the sociological studies, which engrossed him at Chicago, to the philosophical, as opposed to physical, anthropology, which he expounds from his chair at Brussels.

The changed point of view involves an endeavour after a new classification of the sciences of man, a critical determination of the limits of those sciences as hitherto pursued, and a sketch of the unifying conceptions that involves disquisitions psychological, anthropological in the narrower sense, and ethical. To the practical applications of his teaching Prof. Folkmar proposes to devote his life.

Dr. Folkmar may be described as Spencerian, though critically so. He rests much on Letourneau, and has studied in the following of Giddings, Lester Ward and

other of the "new sociologists." He owes something to Guyau. He exhibits on the whole a sober judgment, and is frequently suggestive in his treatment even of well-worn topics. It is therefore the more to be regretted that he has almost buried good work among platitudes, second-hand matter and pretentious technical phraseology, doubtfully permissible in his *conferences* and inadmissible in the *littera scripta* meant to endure.

Terms such as *anthropographie* (of which different misprints occur, pp. 71, 72), *archéographie* (which means ancient geography), and *praxéologie* detract from the merit of Dr. Folkmar's graphic representation, upon the faces of a cube, of the sciences of man. His much use of the word "innervation," defined as meaning simply "a form of vibration of the nervous tissues," is a weakness of the same kind. Nothing, surely, is gained by declaring the question of the unitary origin of the race to be "on ultimate analysis the question of monogenism *versus* polygenism" (p. 127).

More serious in a work of scientific pretensions is what we take to be a missing of the main point with regard to polyandry in the remark (p. 188) that where it obtains many women must needs remain unmarried. That completeness of life can be determined with mathematical exactness (p. 319) needs proof. In an otherwise ingenious suggestion for a grading of scientific asseveration "impossible" (p. 67, line 24) is impossible, and "improbable," which is not improbably the right reading, will not balance the "probable" which has preceded.

In fine, though Dr. Folkmar's ability to supply a text-book of anthropology as he conceives it will not admit of question, and an essay from his pen developing, say, the conception which he would substitute for Mr. Spencer's ethical ideal might prove instructive, his present book suggests the high-class amateur who enters for the first time in a tournament of masters.

H. W. B.

*The Principles, Construction and Application of Pumping Machinery.* By Henry Davey. Pp. xvi + 295; 250 illustrations. (London: Charles Griffin and Co., Ltd., 1900.)

THE purpose of this book, as stated by the author, is to present information on pumps and pumping machinery in such a form as to make it useful to the practical engineer engaged in the application of pumping machinery in mines and for waterworks, or in other positions where large quantities of water have to be dealt with. This purpose has been fairly accomplished. The information given is of a thoroughly practical character and made plain by numerous illustrations, and the book cannot fail to be of great use either to the student seeking information or to the practical engineer engaged in works requiring pumping machinery.

The first chapter contains an interesting summary of the gradual development of pumping machinery. Cornwall may be said to be the land of the birth of large pumping installations. It was here that both Savery and Newcomen brought into use the power of steam for raising water from the mines, and their engines remained in use until Watt introduced the system of a separate condenser. It is not much more than a century and a quarter ago that Boulton and Watt commenced the manufacture of their engines for the coal-mines in Staffordshire and Warwickshire, but it was Cornwall that afforded the great field for the development of Watt's inventions. The progress of this development is interesting. The coal-mines were becoming deeper and very costly to drain. The proprietors were unwilling to incur the expense of removing the old atmospheric engines put down by Newcomen; and to meet this difficulty Boulton and Watt erected many engines at their own expense, taking as payment one-third of the